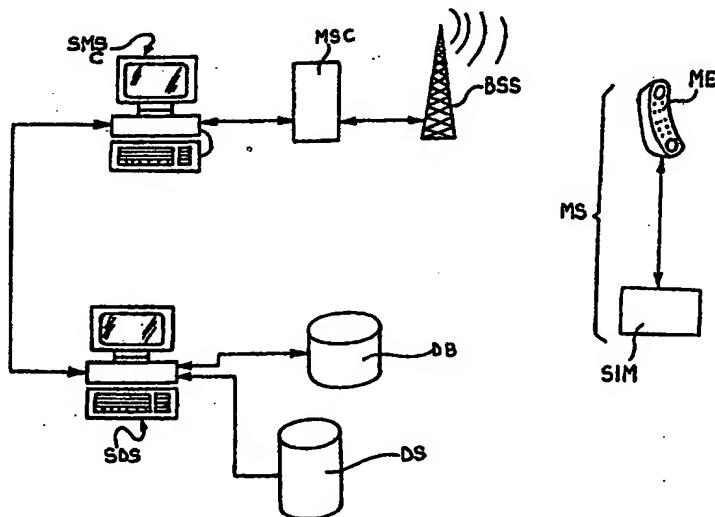




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(54) Title: MOBILE TERMINAL FOR TELECOMMUNICATIONS AND REMOTE SIM-CARD PROGRAMMING



## (57) Abstract

The subscriber identification module (SIM) of the terminal can be selectively so configured as to allow the user – through procedures carried out by the terminal itself – to load into/cancel from the same module (SIM) application programs for the access to respective services. The above application programs (12a, ..., 12e) are received by the terminal, for instance, within the so called short messages of the system. Preferably, the loading and cancelling operations of the above application programs (12a, ..., 12e) into and from the storage means of the subscriber identification modules (SIM) of the mobile terminals are performed under the control of the system server. (Fig. 2)

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## MOBILE TERMINAL FOR TELECOMMUNICATIONS AND REMOTE SIM-CARD PROGRAMMING

The present invention relates in general to mobile telecommunications and concerns, in particular, a mobile terminal for telecommunications equipped with a 5 identity module for the user or subscriber identification: in other terms, that module is the one commonly denoted by the acronym SIM (Subscriber Identity Module) in the systems operating according to the GSM standard. The invention is however applicable, in a similar way, to all the systems that envisage the use of said module, such as, for instance, the systems working according to the DCS 1800 or PCS 1900 10 standards. It is therefore understood that even if the following description is specifically referred to a GSM system and is based on the continuous reference to the relating terminology, this must not be seen as a limitation of the scope of the invention.

More specifically, the invention concerns a mobile terminal for telecommunications according to the preamble of claim 1.

The possibility of configuring the said mobile terminals in such a way as to allow the users to access information services such as, for instance, real time stock exchange information, news of different nature such as sports news, horoscopes, etc, is well known and has been exploited for some time. Both information services 15 aimed at the general public (so called mass market services) as well as services

destined to a restricted area of users (for instance information relating to a company's organisation) can be involved.

The provision of such services exploits the possibility offered by mobile telecommunications systems (and in particular by those to which reference has already been made) of transmitting short messages, comprising fields for the transmission of user data, superimposed to and without mutual interference with the voice signal.

Two different modalities have been devised so far for the access to said services. According to the first one, the user utilises the terminal, and in particular the keyboard of the same, according to criteria substantially similar to those adopted for the use of a keyboard of a personal computer or a similar equipment, i.e. by introducing the required instructions through the keys of the mobile terminal.

This solution however is rather uncomfortable: the keyboard of a mobile terminal for telecommunications usually comprises a limited number of keys (in most cases a number of keys corresponding to that of a standard telephone dialling device, plus a limited set of auxiliary keys). This involves, for instance, that the same key is assigned different operating functions (for instance, a digit plus three letters) as a function of different actuation modalities, such as, typically, the number of times a key is pressed during a given time interval.

For this reason an alternative solution has been devised, according to which the SIM is used for storing one or more application programs that allow the user to access said services through a simplified procedure. By pressing a limited number of keys, the user can cause the automatic execution of the operations required to access the desired service through the respective application program(s) stored in the SIM module.

The main drawback of the latter solution is that the configuration of the SIM (in practice the number and the nature of the application programs stored therein) is fixed: to make possible modifications (for instance, deletion of the application program relating to a service which is no longer of interest and the storage of the application program relating to a new service of interest), the user must go to a technical service centre that is adequately equipped for carrying out the necessary intervention on the SIM. In this respect it must be considered that the identity data of the terminal relating to the execution of the normal communication service are

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stored in the SIM module. Therefore it is in general desirable that the user or any unauthorised third party do not have the possibility of easily intervening on the SIM module in order to modify its content.

This invention aims at providing an improved additional solution, so as to  
5 overcome the above drawbacks.

According to the invention, this aim is attained by virtue of a mobile terminal for telecommunications having the characteristics specifically recalled in the appended claims. The invention also concerns the related system.

In the essence, the solution according to the invention allows customising the  
10 SIM through application programs defined by the operator.

In particular, the solution according to the invention allows implementing a so called middleware, that is capable of communicating with a service centre, for instance, through the short message service (SMS), circuit-switched data transmission services, unstructured data signalling services (USSD) or WAP (Wireless  
15 Application Protocol) application interfaces, in other terms, through so called "system messages".

The service centre may be located at the operator or in a remote position at a service provider, and its communication capability is ensured, for instance, through API (Application program Interface) interfaces. All this is arranged in such a way as  
20 to allow the mobile terminal to store the above application programs (by downloading them from the service centre); which programs can be selectively deleted, when no longer of interest.

In this way, the mobile terminal user is able to selectively vary the number and the nature of the application programs resident in the SIM module of his terminal  
25 according requirements and choices that may vary with time. All the above features are provided without the need of carrying out specific operations for modifying the SIM module and by acting also within a secure environment, through a mutual authentication of the SIM module and of the service centre.

In short, the reference architecture of the solution according to the invention includes on one hand a GSM terminal with SIM (preferably of 2+ phase) on which an application program is resident that enables the loading and deletion of the application programs.  
30

The terminal is capable of communicating via SMS (or through any one of the

various types of system messages mentioned previously) with a service centre where the application programs are actually resident.

In particular, in the embodiment at present being preferred, the solution according to the invention allows the communication between user and server in only one direction: the application program resident on the SIM module sends towards the service centre some commands with a particular syntax to indicate if the user wants to effect a download or a deletion. Once a command has been received, the service centre sends to the SIM the instructions to download into the memory the application programs or to delete them.

This way of acting offers the advantage of rendering the application programs independent from the SIM manufacturers, thereby allowing the actual implementation of the application programs by third parties based on specifications.

The updating of the application programs is managed in a simple way, being the application programs centralised. The SMS transmission is used as a carrier for the application programs, not only for the downloading operations. This solution meets the need of avoiding any overburden of the application programs due to unnecessary SMS traffic.

The solution according to the invention is in particular compatible with the availability of SIMs equipped with a SIM Application Tool kit interface of 2+ phase. It may be implemented with an occupation of about 4 KB concerning the application program resident on the SIM module and responsible for the transmission of instructions towards the service centre. This application program may be resident on both a Read Only Memory (ROM) and on the E<sup>2</sup> PROM of the SIM module that stores the data required for the server authentication by the user.

The invention will now be described purely by way of a non-limiting example, with reference to the accompanying drawings, wherein:

- Fig. 1 schematically shows the general architecture of a mobile telecommunications system incorporating the invention,
- Fig. 2 illustrates the possible internal organisation of the subscriber identity module according to the invention in the form of a block diagram, and
- Fig. 3 is a flow chart depicting the operation of the above module.

Fig. 1 schematically illustrates the essential parts of a mobile communication system, in particular a GSM system. Such parts have been denoted by the respec-

tive acronyms of current use.

Thus, in the representation of the mobile terminal MS, the actual telephone set ME has been separated from the subscriber identity module SIM, that communicates with the telephone set according to the ETSI GSM TS 11.11 and 11.14 specifications.

The acronym BSS identifies the base station of each cell, that communicates (according to criteria governed by the specification GSM 08.0x) with the relating switching system MSC (Mobile Switching Centre). The latter in turn communicates (according to the GSM specification 03.40) with the service centre SMS C for the short message management.

As already said, the above description and in particular the relating acronyms, refer to a GSM system: it is however evident that the same basic arrangement and the same general criteria of operation may be found in systems such as the DCS 1800 and PCS 1900 systems, which, being on the whole equivalent systems, can also take advantage of the invention.

If considered from the standpoint of the general architecture of a system, the invention essentially associates to the centre SMS C with a service provider centre SDS, which, is connected to a database DS of the services provided end, also to a data base DB that contains the relating application programs for the access management, destined to be selectively transferred to the SIM of the mobile terminal MS interested in the services themselves.

As already mentioned, the service centre SDS may be resident at the system operator (and physically situated at the SMS C) or remotely located through the adoption of a connection interface, for instance of API type.

The same rationale may be reproduced for the physical arrangement of the data bases DS and DB, in the sense that - as is evident to the person skilled in the art - there is no specific need for having the data bases located in the same physical location. Besides, at least the data base of the services DS may be in turn located in a distributed way.

The diagram of Fig. 2 depicts in summary the organisation of the SIM module part devoted to the implementation of the invention.

In particular, the reference 10 denotes two files (typically on E<sup>2</sup> PROM) storing two numbers (in particular according to the ITU-T E.164 standard) which can be

selectively dialled by the user (usually by pressing one or more dedicated keys). The first number identifies the SMS C to which the service centre SDS is connected. The second number identifies instead the service centre SDS on which the server application program is resident. The requests for initial access to the services and for presentation of the list of the application programs available on the server are performed using these parameters. The terminal is capable of checking (on the SIM module) that any command arriving through SMS is identified by the provenance (previously specified). The system also is able, through the implicit mechanism of GSM authentication, to check the origin of the requests of access to the services by verifying the 'sender' field (the so called originating address) of the SMS received. In this way it is possible to guarantee the system security through the creation of access lists for restricted services, not generally available as mass-market services. Furthermore, the mechanism of customer identification may be used to customise the services and access thereto.

The solution according to the invention exploits the possibility of having two processes, one resident on the SIM module and the other on the service centre, which by mutually co-operating allow a remote management of the SIM memory and hence of the application programs contained in said memory.

The resident application programs (located in memory area 12) are also registered inside a file 14 which keeps record of the application programs present in the memory 12.

The file 14 has a record-based organisation.

Each application program 12a, ..., 12e stored in the memory 12 is associated with a record that indicates where the application program is stored and the name to which it is associated.

As will be better seen in the sequel, the download or the deletion of each application program 12a, ..., 12e are not complete if, besides the updating of the memory 12, an updating that makes file 14 coherent with the new state of the memory 12 is not carried out.

Block 18 schematises the man-machine interface of the terminal.

The user has access to the functions of download/deletion by virtue of a resident program, initially embedded on the module SIM, denoted by 16 and essentially having management functions. The access to such a program is per-

formed through a menu selection by acting on the keyboard of the terminal ME. Once selected, said program allows the access to an additional menu in which it is possible to choose whether to effect a download or a deletion (according to the terms better illustrated in the sequel).

5        The experiments successfully conducted so far by the applicant are based on the possible storage into the memory 12 of five application programs 12a, ..., 12 relating to a corresponding number of services, such as, for instance, stock exchange service (quotations and index, sports news, personal calls, horoscopes, etc.).

10      Each application program 12a, ..., 12e implies a memory occupancy of about 2 KB.

After the initial step 100, the flow chart of Fig.3 envisages a step 102 in which the user notifies on the mobile terminal his request to access to the set of the services being considered in order to:

15      - access a information service for which the relating access application program is already available in the memory 12 of the SIM module,

        - download into the memory 12 the application program (not available in the SIM module at that moment) required to access a given information service, or

        - cancel from the memory 12 of the SIM module the application program

20      that allows accessing an information service that is no longer of interest.

The relating choice is effected by the user (for instance, through an acknowledgement to a visual signalling that appears - in a known way - on the terminal display) causing the system to evolve towards choice step 104.

In such a step, the system essentially recognises the choice made by the user.

25      Should the user request to perform an interrogation of one or more services for which the terminal already has the relating application program, the system shall evolve towards the relating interrogation sequence, schematically denoted by 106. This sequence is already known and therefore it does not require to be described herein, also due to the fact that it is not significant for the understanding of the invention.

If however the system recognises that the user wishes to download on the SIM module an application program available at the service centre SDS but not yet present on the SIM module itself, the system evolves towards a step 108 corre-

sponding to the presentation of the application programs that may be downloaded. Such presentation is obtained by the management file 16 as a difference between the list of the application programs available at the service centre SDS and the list of application programs present at that moment in the memory 12.

5 Therefore, when choosing an application program among those proposed there is no risk of trying to download an application program already present in the memory 12. The list of the application programs present in the memory 12 is obtained by scanning the file 14, whereas the list of the application programs available at the service centre SDS can be embedded into the code as a constant.

10 Obviously, one may also assume an alternate solution in which such a list is periodically updated by exploiting for instance the short message transmission mechanism or one of the other types of system messages, already cited before.

15 The next step 110 in Fig. 3 indicates the choice made by the user by acting on the keyboard of the terminal MS, of the new application program required among those available.

After the choice of the application program to be downloaded, the management file 16 sends towards the service centre a command indicating the type of command to execute (downloading denoted for instance by a letter "L" at message start) and the name of the relating application program (step 112).

20 Upon reception of such command, the server of the service centre SDS sends towards the SIM module the commands required for downloading into the memory the relating application program and for updating the file 14 (step 114).

25 A further possible outcome of the choice step 104 is the identification of the fact that the user requests to delete an application program among those present in the memory 12.

This can take place according to substantially complementary modalities with respect to those previously illustrated with reference to the downloading operation (steps 108 to 114).

30 In the embodiment of the invention being at the moment preferred by the applicant, the operation of deletion is simplified by imposing that the application program to be cancelled is last one loaded into the memory 12. This allows simplifying the management of the memory 12, in that a possible re-compacting of space which becomes free is not required.

Through the adoption of this simplified solution, once the user has chosen the operation relating to the deletion, the management file 16 does not ask which application program must be deleted, for it is known a priori that the last one will be cancelled. This will be recognised by accessing the last record of the file 14. The relating name serves to prepare the command to be sent (in the step 116) to the service centre SDS to request the cancellation. Once this command has been received, the centre SDS sends to the SIM module the instructions required to erase the memory area occupied by the application program and to cancel the relating item from the register 14 (step 118).

The sequences of steps illustrated in Fig. 3 and relating to the operations of downloading and deletion are represented as destined to re-converge upstream of the choice step 104.

As a matter of fact, it has here been assumed that the subsequent evolution of the system, also in view of the stop, occurs within the interrogation function represented by block 106.

It is evident that, leaving unchanged the principle of the invention, the implementation details and the practical embodiments may be considerably varied with respect to what has been already described and depicted, however without departing from the scope of the invention itself, as disclosed in the following claims.

**CLAIMS**

1. Mobile terminal for telecommunications comprising a communication module (ME) capable of receiving system messages (SMS) and a subscriber identity module (SIM) equipped with storage means (12) for storing at least one application program (12a, ..., 12e) for the access to a respective information service, characterised in that said storage means (12) can be selectively configured in writing and cancellation, for storing and cancelling application programs (12a, ..., 12e) received by the terminal (MS) through said communication module (ME) within said system messages.  
5
2. Terminal according to claim 1, characterised in that said storage means (12) are equipped with register means (10) for storing a first code identifying the terminal (MS) and a second code identifying at least one service centre (SDS) with access controlled through said at least one application program, said first and second code being used as parameters for storing said application programs into said storage means (12)  
15
3. Terminal according to claim 1 or claim 2, characterised in that said storage means (12) are equipped with at least one additional register (14) capable of containing, an identity information for each of said application programs that may be stored and cancelled and in that they are provided with control means (16) for the configuration of said storage means (12) acting in a co-ordinated way on said storage means (12) and on said additional register (14) so that the storage and cancellation of an application program on said storage means (12) are accompanied by the corresponding modification of the respective information present in said additional register (14).  
20
4. Terminal according to any one of the previous claims, characterised in that said storage means (12) are associated with control means (16) that are capable of detecting a user command (104) relating to the storage of a respective application program on said storage means (12), of forwarding (112) a respective storage command signal toward a respective service centre (SDS) starting  
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from the terminal (MS), of receiving from said service centre (SDS) through said communication module (ME) a corresponding storage signal, and of storing (114) into said storage means (12), as a consequence of the reception of said storage signal, the respective application program.

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5. Terminal according to any one of the previous claims, characterised in that said storage means (12) are associated with control means (16) that are capable of identifying the application programs (12a, ..., 12e) for the access to a respective information service that are present on said storage means (12), of comparing the identified application programs with an overall list of the available services, and of generating a subtraction signal that can be presented to the user and that identifies the application programs for the access to a respective available information service for the storage on said storage means (12).
6. Terminal according to any one of the previous claims, characterised in that said storage means (12) are associated with control means (16) that are capable of detecting a user command (104) relating to the cancellation of a respective application program from said storage means (12), of forwarding a respective cancellation command signal (116) towards a respective service centre (SDS) starting from the terminal (MS), of receiving from said service centre (SDS) through said communication module (ME) a corresponding cancellation signal, and of cancelling (118) from said storage means (12), as a consequence of the reception of said cancellation signal, the respective application program.
7. Terminal according to claim 6, characterised in that said storage means (12) are configured so as to carry out the cancellation of the application programs (12a, ..., 12e) for the access to a respective information service, that are stored in such storage means (12), starting from the last application program stored.
8. Telecommunications system comprising:
  - a plurality of mobile terminals according to any of the claims 1 to 7,
  - a data base (DB) of said application programs (12a, ..., 12e) for accessing

## 12

a respective information service, and  
communications means (SDS, SMS, MSC, BSS) to forward towards the  
communication modules (ME) of said plurality of mobile terminals (MS)  
system messages selectively conveying said application programs for the  
storage on said storage means (12) of said mobile terminals.

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9. System according to claim 8, characterised in that said data base (DB) is  
associated with respective management means (SDS) that are responsive to  
the reception, from said plurality of mobile terminals (MS), of respective  
10 command signals for storage and cancellation of said application programs  
(12a, ..., 12e) into and from the storage means (12) of said mobile terminals  
(MS), the arrangement being such that said application programs (12a, ..., 12e)  
are stored into and cancelled from the storage means (12) of said mobile  
terminals (MS) only following the emission (114, 118) of respective storage and  
15 cancellation signals by said management centre (SDS).

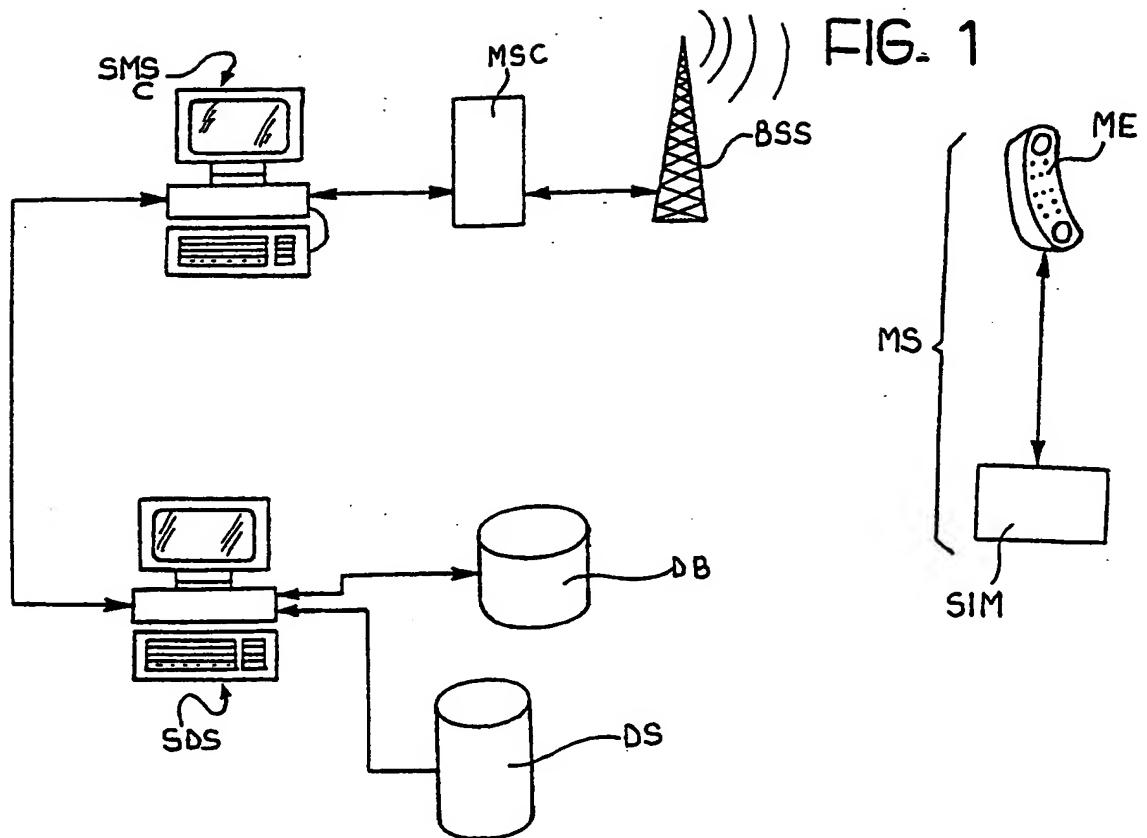
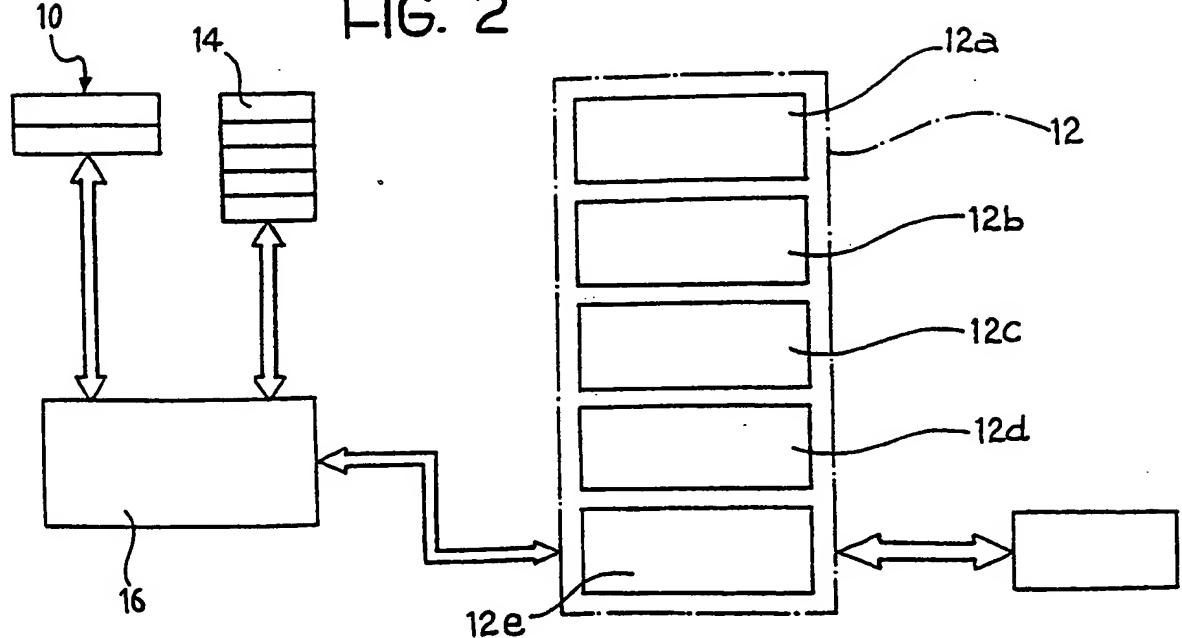
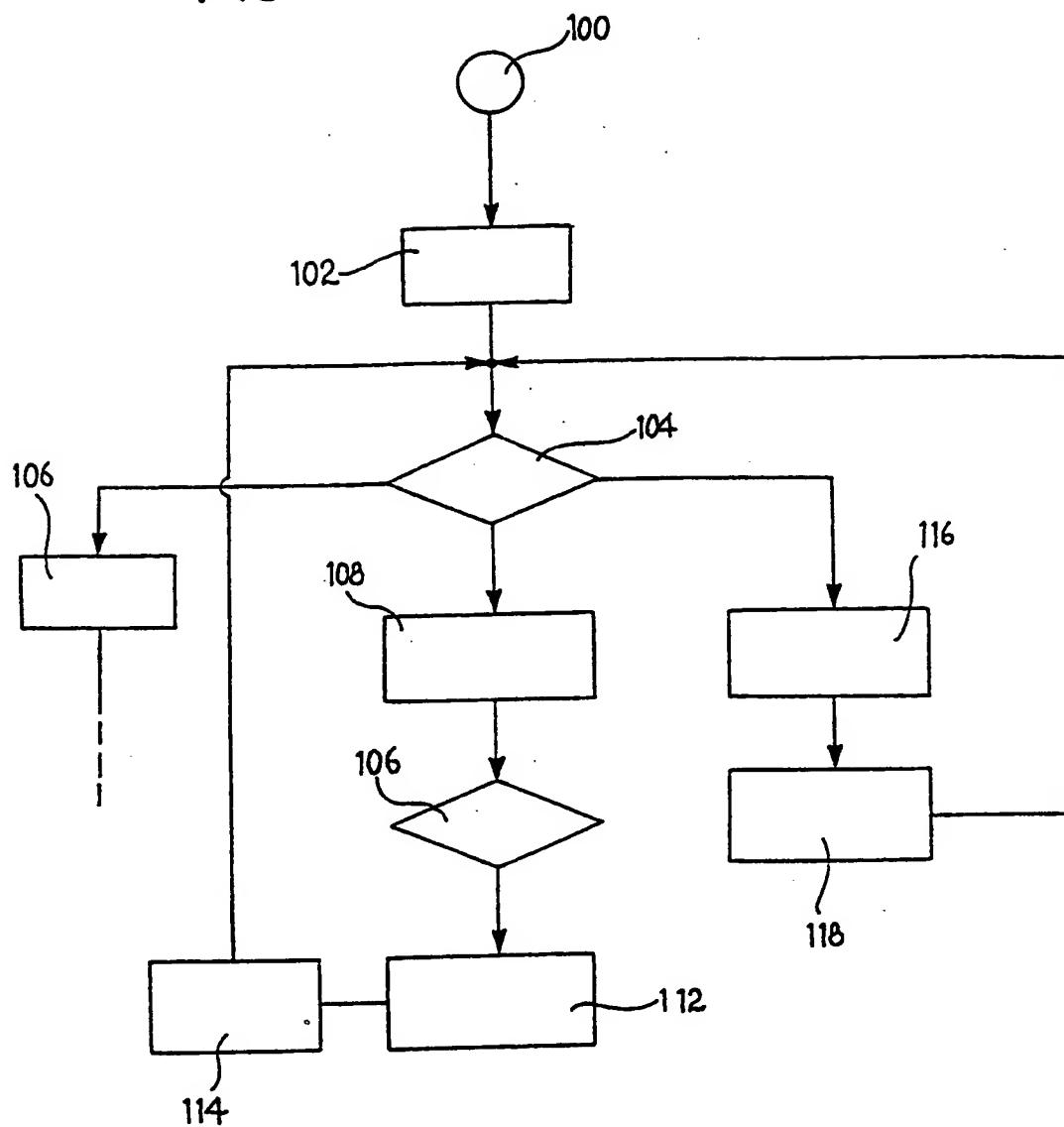
**FIG. 2****SUBSTITUTE SHEET (RULE 26)**



FIG. 3



SUBSTITUTE SHEET (RULE 26)

